Possibilities of Enacting and Researching Epistemic Communities

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Abstract

This article explores what the concept of epistemic community can contribute to studies of science and technology and to existing analytical frames of epistemic cultures, technosocial network and community of practice. Reviewing conceptions of epistemic community in political science, organisational studies and feminist epistemologies I suggest that heuristic dimensions include a focus on historical contingencies and timings; on particular epistemic projects and technologies that work as boundary objects; and on epistemic responsibilities and stratifications. These dimensions are further explored in two research vignettes. The first vignette follows the mobilisation and expectations of the Czech synchrotron user community at a funding event as a focal point for examining epistemic responsibilities and the genderings of community. The second vignette follows a biographical narrative about being and becoming a member of an epistemic community and amplifies the importance of different configurations of community. I argue that the contours, distributions and textures of an epistemic community cannot be studied at a single analytical site such as the laboratory and conclude by outlining what can be gained by using a refined concept of epistemic communities and sketching some strategies for further research.

Keywords: Epistemic Community, Epistemic Responsibility, Epistemic Cultures, Community of Practice, Gendering of Community, Synchrotron User Community

Introduction

1.1 To suggest that it is productive to revisit and research epistemic communities may appear ill-conceived at a time when the notion of community and its connotations of a level of persistence, familiarity and solidity appear to be at odds with the incessant movements and circulation of knowledge workers, technologies and objects, and the intensification and speeding up of (electronically) mediated connections and communication. Within science and technology studies (STS), researchers engaged in ethnographically oriented laboratory studies rejected the idea that scientific communities were meaningful units of analysis for studying knowledge production practices. Knorr-Cetina (1981: 68-9), for example, forcefully argued against 'the notion that professional membership groups (called scientific communities) are the relevant units of social and cognitive organisation of science'. This rejection was grounded in a critique of the overtly positive connotations of normative and cultural integration and cooperation in such communities that downplayed the role of competition, antagonism and stratification – tensions that led Gieryn (2005: 550) to qualify the concept of scientific community as 'oxymoronic'.[1] More importantly, however, a focus on professional communities was found to ignore the formative role of administrators, grant agencies, government officials and others who in Knorr-Cetina's terms bear directly on the 'technical selections' made in the laboratory. Endorsing the importance of 'variable transdisciplinary fields' (Knorr-Cetina 1981) for knowledge production Latour and Woolgar ([1979] 1986: 66) suggested that 'every move in the laboratory relies in some way on other scientific fields', pointing to the ways in which scientific findings from other fields get incorporated in pieces of apparatus used in the laboratory. Knorr-Cetina also raised doubts that specialist communities were relevant for the subjectivities of scientists, citing Whitley (1978: 127) who found that 'for many scientists … such relatively broad organisational units are largely irrelevant and often unknown'.

1.2 A 'second generation' of ethnographic studies in STS has now broadened their field beyond the bounded habitat of the laboratory to include a more diverse range of sites and actors, including lay groups, activists, media and popular culture (Hess 2001; Markus 1998; Hine 2007). While such 'multi-sited' research – including research into virtual encounters and e-science that traces associations, connections and translations among sites that are 'worlds apart' (Markus 1998: 96) – appears well suited to follow and study

diverse epistemic communities, the concept is rarely used. For example, the often-cited study by Heath et al. (1999) examines knowledge practices on heritable tissue disorders across a variety of online and offline sites, including web pages and mailing lists run by people affected by particular disorders in which they practically and theoretically engage with and create transformative (medical) knowledge on the condition. Even though embodied subjectivities appear strongly implicated in knowledge production the research is framed in terms of researching nodes of a complex *technosocial network*, rather than in terms of epistemic community, most likely to foreground the intersections between people, places and electronic artefacts. Other researchers use the framework of *epistemic cultures* to study the 'cultures of creating and warranting knowledge' (Knorr-Cetina 1999: 1) in fields such as high energy physics or women's studies (Beaulieu et al. 2007). This framework has a strong comparative element of reading cultures against each other along three dimensions (the empirical configurations of research objects; the particular ontologies of instruments, machines and technologies; and the social configurations of epistemic subjects). Yet others have mobilised the frame of (virtual) *communities of practice*, initially developed as a theory of learning where a central analytical focus is on the multiple and varied practices of becoming a community member through participation in a field of practice and mutual engagement (Lave and Wenger 1991). The concept has since moved into organisational studies where organisations are considered to purposefully facilitate the sharing of tacit knowledge through face-to-face and virtual interactions (Duguid 2005; Dube et al. 2006).

1.3 These existing analytical frames are sometimes scalarly ordered such that epistemic cultures are conceived of as a network of practice of a global reach 'that has within it multiple local communities of practice' in which locally acquired know-how allows for a global exchange of 'know that', that gets reembedded in local practices (Duguid 2005: 113). A central question of the present article is how the concept of epistemic community can contribute to these existing frames. What are relevant analytical foci, and how can epistemic communities be empirically researched? Holding that epistemic community is a concept in the making and that its plurality of meanings should not be prematurely closed down I begin to tease out relevant heuristic dimensions by exploring its usages and enactments[2] in political science, philosophy and more recently in organisation studies and STS. I also draw on field observations and interviews with physical and bio-scientists in the Czech Republic who were invested in building and imagining (epistemic) communities.

1.4 The paper is organised as follows: the first part outlines clusters of meaning as well as areas of contention by comparing the use of epistemic community in political science, organisation studies, STS and feminist epistemologies. I examine what kinds of sociality of knowing the concept denotes and enacts, what epistemic communities do and what holds them together. Taking a lead from (feminist) science scholars and philosophers I also explore what theorists of epistemic community may have to say about the *gendering of such communities.* Knorr-Cetina (1999) had observed that different epistemic cultures gender researcher and research communities in different ways.[3] Feminist scholars have also flagged the importance of *epistemic response-ability* of knowers for their interventions and the kinds of communities, cultures, locations and technologies that make knowledge production possible – a responsibility which is at once ethical and political (Code 1994; Haraway 1991; Longino 2002). Arguing that theorists should take seriously different locations and social hierarchies in knowledge production, they have contributed to broadening the scope of responsibility as an epistemic virtue to include respect and acknowledgement of more marginalised epistemic agents (Townley 2006). Importantly they have reformulated responsibility as relational and collective. Thinking through Spinoza's philosophy Gatens and Lloyd, for example, have argued that because identities are constituted in sociality through being affected and modified by other bodies, and bodies (and social institutions) retain traces of past modification, 'we are responsible for the past not because of what we as individuals have done, but because of what we are' (Gatens and Lloyd 1999: 81). Belonging to particular collectivities, in this view, calls for the obligation of taking 'responsibility in the present for the manner in which one's constitutive imaginary harms, excludes and silences others' (ibid: 143). Here I examine how theorists of epistemic community have taken epistemic responsibility into account.

1.5 Based on a provisional outline of what the notion of epistemic community entails, the second part of the paper draws on research conducted in the Czech Republic in the framework of the project *Knowledge, Institutions and Gender: An East-West Comparative Study*[4] and presents two research vignettes on the making of epistemic communities that add to the thinking about how epistemic communities can be researched. The first vignette focuses on the mobilisation of ‘the synchrotron user community’ at an event’ to secure international funding for a research infrastructure and suggests that expectations and imaginations are a fruitful focal point to analyse the interrelations of an epistemic community with other communities, and to scrutinise epistemic responsibilities. The second vignette follows a biographical narrative about being and becoming a member of an epistemic community that necessitates crossing national boundaries and amplifies the importance of different configurations and distributions of community that is enacted at local/global scales. I then examine whether a research laboratory can be considered an epistemic community and an adequate unit of its analysis. I conclude by outlining what can be gained by

using a refined concept of epistemic communities and sketching some strategies for further research.

What constitutes an epistemic community?

2.1 Distinctive features of what constitutes and holds together an epistemic community can be illustrated by outlining its conception in political science, STS, organisation studies and feminist epistemology. In political theory Ruggie (1975) linked the concept to Foucault's notion of *episteme* as an apparatus that makes it possible to qualify statements as true or false at a particular conjuncture. Ruggie also referred to Holzner (1968) who is sometimes credited for coining the term and who had argued that members of an epistemic community share similar 'frames of reference' associated with specific social roles: 'Epistemic communities may be said to consist of interrelated roles which grow up around an episteme; they delimit, for their members, the proper construction of social reality' (Ruggie 1975: 570). An important analytical focus is how such a community 'becomes institutionalised internationally' and the role of technocratic training, 'scientific and technological images' and similarities in scientific outlook (ibid). This conception anticipates some elements of the perhaps most widely cited definition put forward by Haas as a framework for studying international policy coordination. For Haas epistemic communities are made up of 'a network of professionals with recognised expertise and competence in a particular domain and an authoritative claim to policy-relevant knowledge' (Haas 1992a: 3). These transnational expert communities may comprise actors of different backgrounds who are however bonded by a shared set of normative and causal beliefs and a shared policy enterprise. Like Ruggie, Haas sidelines the process by which such epistemic standards are forged and knowledge generated, focussing instead on how epistemic communities develop and translate their problem definitions into policymaking and coordinated action. His empirical work on ecological epistemic communities suggests that the boundaries of such communities are permeable and changing, including also policy makers at later stages of community development (Haas 1992b).

2.2 Haas's definition is also the vehicle through which the concept of epistemic community has travelled into science and technology studies. Here researchers have traced, for example, how an epistemic community made up of international organisations, evolutionary economists and civil servants translated an Innovation Systems framework (that sees 'innovation' and business as the principal instrument and actor of economic development) into Canadian science policy (Albert and Laberge 2007); or how a public engagement community developed in the UK that legitimated and extended 'participatory machineries of knowledge' (Chilvers 2007: 2992). Halfon's (2006) work on the transnational 'population and fertility epistemic community' that emphasised women's empowerment rather than population control conceptually adds a focus on what could be termed *techno-epistemic practices:* Halfon details how the international demographic survey became a key actor in producing, training and disciplining this community by 'establishing rituals of knowledge-making – common methods, sources of data, and routines of work' (ibid.). Thus, the population community was extended by a process of socio-technical enrolment of local personnel who were trained and enculturated in standard sampling techniques and hierarchical organisational structures. The survey also produces a standardised representation of Third World women in need of contraception that acted as 'boundary object' (Star and Griesemer 1989) to forge consensus: while encompassing contrasting policy visions it allowed community members to act 'as if' they shared a common vision on women's empowerment.

2.3 The organisation studies literature develops a related conception on a smaller scale: according to Amin and Roberts (2008) who stress the experts' heterogeneity and multidiciplinarity, epistemic communities are transient collaborations of experts who deliberately come together to produce new specialised knowledge and innovation. Members mobilize their difference and heterogeneity, and knowledge is distributed and co-evolves. Thus, epistemic communities cohere around loyalty to shared projects (or shared objectives and technologies) that operate as boundary objects. Communication and exchange of knowledge between experts from different disciplinary fields is enabled by the codification of tacit knowledge in these expert domains and a combination of periods of 'organised slack' (Lindkvist 2005) and intense interaction. This is contrasted with the 'non-intentional knowledge work in communities of practice' (Amin and Cohendet 2004) that tend to be more informal, based on shared repertoires and bound up with practitioners' identities.

2.4 Finally, feminist philosophers have long argued that because knowledge production is necessarily social and 'producing knowledge is less a matter of face-to-face confrontation with data than a negotiation within an epistemic community' (Code 1995: 28-29), epistemic communities must be submitted to critical analysis (e.g. Code 1994; Longino 2002; Nelson 1993). Nelson, who explicitly develops a conception of epistemic community, conceives it as 'a group or community that constructs and shares knowledge and standards of evidence' (Nelson 1993: 124). Her example of man-the-hunter-theory that draws on theories and models from primate anatomy, neurobiology, evolutionary biology and geology underlines actual or potential heterogeneity within a community as well as its historical contingency. Importantly, epistemic communities are conceived as dynamic and radically interdependent with other knowledge projects. Multiple memberships, e.g. in a science and feminist community can provide resources for scrutinising

theoretical warrant of particular epistemic projects, including 'common sense assumptions and experiences of gender relations and dominance hierarchies' (Nelson 1993: 146). Individuals in Nelson's view can contribute uniquely to the knowledge generated by a community but such knowledge is made possible and is compatible with the standards of one or more communities she is a member of – which suggests that epistemic responsibility for particular standards and knowledge claims concur to epistemic communities, not individuals. This can include accountability for how epistemic authority and credibility within an epistemic community are gained and distributed (Grasswick 2004). In contrast to Nelson, Code (1994: 13) seems to hold a both-and stance, arguing both for a genealogical analysis of what makes certain epistemic communities possible and for holding individual researchers 'who still apply for and accept research grants and honors in their own name' morally and epistemically accountable for the epistemic projects they collaborate on.

2.5 Despite considerable variance in these conceptions some distinct features emerge that help distinguish epistemic community from the notions of technosocial network, epistemic cultures and community of practice although there are overlaps. First, in contrast to a degree of permanence implied in the epistemic culture and community of practice approaches, epistemic community – as the evocation of *episteme* implies – insists on historical contingency. *Epistemic communities are timed*: their life time 'is limited to the time and space defined by the problem and its solutions' (Adler and Haas 1992: 371), 'they evolve, dissolve, and recombine' (Nelson 1993: 125); they have different intensities and speeds, compared to the 'slow time' associated with communities of practice in particular. Second, while knowledge is necessarily situated, embodied, and made, *members of an epistemic community are often not co-located* in their everyday lives but may come together in meetings, conferences, email correspondence or mailing lists. As with communities of practice, members can belong to more than one epistemic community. Third, in contrast to the concepts of epistemic culture and technosocial network, theorists of epistemic community unapologetically embrace '*community* as an all-important site of knowledge production: the site where hybrid knowledge inputs meaningfully interact' (Amin and Cohendet 2004: 9). This does not mean that such interactions are non-hierarchical or divorced from the technical as illustrated by the technology of the survey, or participatory techniques, that operate as community- and knowledge (standard) building devices (Halfon 2006; Chilvers 2007). Yet, shared frames of reference or techniques do not necessarily produce substantive consensus: *epistemic communities often cohere around projects, techniques or frames that operate as boundary objects* (Amin and Roberts 2008). Fourth, flagging the human element in an epistemic community allows *raising questions of epistemic responsibility with respect to (gendered and gendering) problem definitions, epistemic standards and visions*, not limited to individual experts and their intentions. This is developed in feminist epistemology in particular, whereas political and organisational theorists are more prone to assume that the policy interests of experts are 'benevolent' (Haas 1992a) or to implicitly endorse members 'unrestricted "entrepreneurship" as to how [innovation goals] may be reached' (Lindkvist 2005: 1203). Although not developed by the theorists discussed here, it also allows scrutinising (gendered) stratifications within epistemic communities, and looking at distributions of epistemic privilege.

2.6 I will now move on to explore some of the ways in which particular kinds of communities that could qualify as epistemic communities in the sense outlined above have been mobilised and articulated by scientists and other innovation actors drawing on observational and interview research that I undertook at a prominent research organisation in the physical and biosciences in the Czech Republic. The presentation takes the form of short vignettes or stories that aim to sketch relevant contexts and analytical foci along which epistemic communities around the four dimensions can be fruitfully researched in social studies of science and technologies.

Vignette 1: An epistemic community in the making or: figuring the synchrotron user community

3.1 During my fieldwork that was largely based on following scientists from two research groups in their everyday life in laboratories, offices and seminar rooms, I sensed an opportunity to trace what could become an epistemic community when a senior scientist I was working with accepted an invitation to contribute a proposal for the construction of an experimental endstation as part of a wider bid for establishing a large-scale research infrastructure in the Czech Republic. The project was one of several proposed Centres for Excellence that sought funding from the European Structural Funds. These funds are currently made available by the European Commission particularly to Central and Eastern European member states to boost their capacity for innovation by upgrading or building scientific infrastructures in accordance with its aim to create 'world-class "knowledge and innovation communities"' (Commission of the European Communities 2007: 5). The proposal for the facility brought together members of several sub-communities in the physical, material and biosciences sciences that had worked with synchrotron radiation. From the outset a key concern was the demonstration of interest and inputs of a sizeable 'user community' for a particular beamline (including potential industrial users) that would warrant the investment, a concern also central at an international meeting where the project was showcased to national and international policy makers and funders.

3.2 In outlining some of the ways in which 'the synchrotron user community' was assembled at this meeting, I want to draw attention to the role of expectations, imaginations and genderings that were constitutive of this community and may provide a fruitful starting point for analysis. Prior to the meeting the scientist I observed had worked on the proposal for novel instrumentation, the endstation. With this proposal she contacted previous collaborators in the Czech Republic and abroad to submit 'pre-proposals' that laid out the kinds of research projects they would conduct with the new beamline. These details further fed into its design, scripting future users into the epistemic technology. Anticipating the expectation of funders that there be a sizeable user community in her research field she also ran tutorials on the applications of the new technology and took an interested colleague to a facility abroad to gain hands-on experience so that he could qualify as a user and sign the proposal. Pre-proposals of potential future users were attached to the beamline proposal as warrants for its innovative potential and as evidence of a viable existent user community. This already points to the paradox that in order to warrant future investment for innovative technology, an innovation community already has to be in place, a condition that risks disadvantaging science communities that have been historically under-resourced. In the process of putting the proposal together the scientist became 'beamline coordinator', that is the spokesperson for a particular epistemic technology and user community.

3.3 At the meeting where the overall project was presented to decision makers of the European Commission in an effort to gain a favourable opinion with respect to funding the facility, a range of expectations of social, economic and scientific benefits were articulated. These expectations and imaginings figuratively filled the void on a geographical map reproduced at the meeting that marked over 14 synchrotron facilities in Western Europe and left Central and Eastern Europe empty. Importantly, they linked 'the' Czech synchrotron community (made up of fairly distinct sub-disciplinary user communities) to other communities, figuring it as embedded in and having permeable boundaries with science and society. For example, investment in the facility was said to benefit 'Central European science communities' that were under-funded and thereby would make the EU more competitive as a whole; local communities were expected to benefit from new employment and training opportunities; and the national synchrotron community was expected to flourish, enriched by attracting Czech researchers currently working at facilities abroad who would 'return home' and by leading scientists from abroad who would enliven scientific life in the Czech Republic. The synchrotron community was thus enacted as a 'community of promise' (Brown, 2003: 6), that is a community within which a wide range of aspirations, expectations, hopes and imaginings 'structure and organise a whole network of mutually binding obligations between innovators, inventors, consumers, regulators and so on'. Expectations materialised in a memorandum on collaboration between the Czech academy of sciences and representatives of a Western European facility that was in the process of construction. Future visits of Czech scientists and engineers to this site were expected to guarantee a transfer of expertise which in turn was expected to shorten the period of construction of the Czech facility and to cut costs. Prominent representatives of 'the global x-ray community' who where present to exchange experiences both supported and controlled the particular beamline proposals for, as one representative of a renowned Western facility put it, 'if we have one sort of player in the synchrotron orchestra who is at the end not doing well, it weakens the whole orchestra'.

3.4 While the presentations of scientists and policy makers appeared to address the question what and for whom the synchrotron was good for, epistemological questions remained marginal. Intent on avoiding building 'cathedrals in the desert' potential funders appeared to be more interested in the size of different beamline user communities than in the (very different) kinds of knowledge projects they would afford.[5] Importantly the perceived need to present certainty and unity vis-à-vis transnational and national funders forestalled the articulation of doubts and uncertainties by members of the synchrotron community and by their critics. Local proponents of alternative, potentially competing, proposals had not been invited. Some attended anyway fearing that the synchrotron project that had been organised more recently could 'hijack' available funding at the expense of more broad-based initiatives to upgrade laboratories. In the meeting concerns that the large operating costs of the facility which had to be paid from the annual national R&D budget would take resources away from science communities rather than strengthening them were cut short. There was an intense sense of behind the scenes politicking visualised by the rows of empty seats of Czech (male) participants while the project was presented. Proponents, critics and mediators were engaged in lobbying science representatives and ministers as one participant explained who was pleased that he had told the person about to be appointed minister for education 'all he had to know'. Privately one of the beamline coordinators questioned whether the facility was worth the investment. It would produce some nice crystals to be sure but if the same amount of money were to be invested in the best laboratories, it could, he said, produce two Nobel Prize winners.

3.5 Although often taken for granted gender, or more specifically a masculine enactment of community was also at play in building the emergent synchrotron community. At the meeting the performance of outward confidence and unanimity as well as intense private and public networking between almost exclusively male funders, politicians, and synchrotron and state representatives enacted the emerging Czech synchrotron

community as a masculine homosocial fraternity – visualised in the final group photographs of a collectivity in suits displayed on the project website. One of the women who had dutifully remained seated and prepared an elaborate defence of the project while her male colleagues talked to the ministers personally criticised the overt networking and perceived lack of preparation for the final panel discussion.

3.6 At least three points emerge from these brief observations which may further accentuate the contours of epistemic communities and the possibilities and challenges in researching them. First, the vignette supports suggestions that epistemic communities can be productively studied in their emerging stages (see also Molyneux-Hodgson and Meyer 2009; Chilvers 2007). In the case of the synchrotron user community this means that we can study a community in the making, a community whose members are co-designing (largely via email correspondence) – and mobilising around – an epistemic technology that functions as a boundary object, years before the technology and a more co-located community of practice materialise. A starting point for further investigation could be following the interactions of beamline coordinators or other spokespersons, practices that may also bring into critical visibility some gendering practices such as the persistent refusal of some senior professors to respond to requests from more junior women scientists. Second, I have suggested that epistemic communities can be fruitfully studied when they get together with other kinds of communities (policy makers or funders for example). Here a multiplicity of expectations get performatively articulated that are both necessary to drive and legitimate a particular epistemic project but also enact certain futures at the expense of others. While such articulations promise to afford an analysis of how actors 'take responsibility in the present for [their] constitutive imaginary' (Gatens and Lloyd 1999: 143) the vignette also gives a sense of the power relations, careers and reputations at stake and at play which effectively undermine possibilities that 'private uncertainties within innovation communities … find routes into wider public spaces and times' (Brown 2003: 18), particularly in situations of severe resource competition. It also amplifies the degree to which accountability and (epistemic) responsibilities for particular futures are co-constituted with other constituencies – they never rest with an epistemic community alone. Further investigation could trace the circulation of expectations of the synchrotron user community in different contexts, tracking what Brown (2003: 5) calls 'a knowledge economy of expectations' so that they can be more widely reflected upon. Last but not least the vignette suggests that emerging epistemic communities are marked by gender/ings. While these are likely to be modes of enactment that scientists and others bring into emerging communities, such communities may also afford opportunities to do gender differently. Women scientists taking on leading positions in such projects are a modest example, the implications of which need to be further explored.

Vignette 2: Narratives of being and becoming a member of an epistemic community

4.1 Another route into exploring epistemic communities is to follow the narratives of its members. Here I want to examine how research participants describe their memberships, identifications, engagements and pathways into and possibly out of particular communities that broadly fit the four criteria outlined above. This can give further insights into the spaces and times of epistemic communities, their local/global configurations and enactments, the differential forms of epistemic agency and responsibility they may afford and the personal meanings associated with them at a particular present. In this vignette I focus on a single narrative of a scientist, J, and explore how she narrated her participation in the X [sub-discipline] community in the present, past and anticipated future. J was in her mid 30s and had just taken up a position of group leader when I first met her.

4.2 When introducing the X community she felt she belongs to, J instantly pointed to specific technologies that enable community practice.

> Actually I feel I am a member of the X community and actually this is a very active community. We have a mailing list and I really feel that this is really a community because people know that this field is experience based – a lot of things that you use for X are just [gained] through trial and error – so you really gain from your experience. And people are very happy to share their experience among the X [practitioners]. And also the X programmes are for free, you can download them. The community has big support from the programmers. They have a mailing list where any student can ask the most stupid question. […] And when you follow the discussion you see many people answering and then at the end the person who asked sends an email in which he or she puts the review of all answers he or she got.

4.3 The epistemic community J identifies with is delimitated by a specific research subject and epistemic technique. What renders this research field 'really a community' is the communality of sharing research experience among its members, not so much in face-to-face interaction as in an online exchange of know-how and verbal articulations of experience. Community engagement is self-organised, enabled and materialised not merely by laboratory equipment but a mailing list, software programs and other communities (programmers). The community is described in highly positive terms as open, responsive, egalitarian and democratic: through the sharing of experience it enhances the epistemic agency of its

members regardless of their position; regardless also of where they are physically located. By indicating that members get different kinds of advice which they review and synthesise, the mailing list as a community building device (see Molyneux-Hodgson and Meyer 2009) is also a site for negotiating epistemic standards in the community. J's account emphasises shared understandings and renders other things absent: potential disagreement or clashes of epistemic frames, organisational or geopolitical hierarchies, and competition within the community, for example.

4.4 Differences within the X community emerge in J's biographical narrative of how she became a member, which is marked by the theme and rhythm of going (to the West), learning, and coming back (to the Czech Republic), a journey of apprenticeship and changing locations where new goals arise once qualifications are gained; a narrative of mobility which portrays the community as geographically dispersed, differently resourced and in flux. After her Master's degree J got into her current specialisation when the lab leader of the group she was working with acquired new equipment and decided that a particular technique that thus far had been outsourced to facilities abroad was to be introduced in the lab. At this point the X community in terms of existent practices and technologies was not locally present in the Czech Republic. J went to take courses abroad and used on-line teaching materials issued at western universities; later she took up a fellowship at a renowned laboratory in Western Europe 'and then step by step I learnt X and that's why my PhD took almost seven years'. Once she mastered the particular technique she continued her specialisation in order not to contract out further stages of the knowledge making process. Even though these undertakings suggest determination and initiative, J adopted an embedded subject position that highlights contingencies and flows ('I came at the right time, I took the possibilities that were there… it was just a flow, I never made any big decision [to do X]'). This contrasts with more agentic subject positions adopted by many male researchers who tended to narrate their trajectories as sequences of personal decision and choice. In ever larger circles the movement is westward (and back) while J moves into her current specialisation and becomes a member of 'the' X community, a community whose particular (local) practices and techniques she 'brings' to the Czech Republic.

4.5 J's epistemic agency is always locally configured, contingent on resources and organisational structures. For example, she remarks that the institute she worked at in the US 'had a budget much higher than the science budget of the Czech Republic' so that they could afford better experiments. Yet doing these experiments also required the consent of the lab leader. Places of community were changing too. While the US remained the place where the latest versions of the X programme were developed, which was one reason for her to undertake regular research trips back to the US, in view of more recent acquisitions she contended 'we have better equipment here' [in the Czech Republic]. Epistemic agency was also figured as the ability to 'make a difference' and to develop and shape the X community in the Czech Republic.

> I really feel I did a good thing coming home and I really think in the US I would be one of 10 000 X [practitioners]. Here I am one of 10. And you really can make a difference here. Whatever I do will have an impact on the small X community, so I think I am more useful here.

4.6 For J building the X community at home became a personal epistemic project in which the making of community, also phrased as a service to the community, merged with the making of her career, just as developing epistemic agency of her students and collaborators enabled her own. By drawing on her own learning experience some of J's practices as lab leader transformed existent practices at the Institute, such as her habit of spending time working in the lab and 'looking at people's hands', a practice no longer deemed appropriate for a head of laboratory. The acts of (re)producing and transforming the X community also was an integral part of her definition of scientific excellence that diverged from the common emphasis of outstanding *individual* performance (usually measured in terms of publications or patents) by including teaching and the production of capable and independent students as a marker of (local) excellence.

> [Excellent science] is of course good publications, but I think doing excellent science is also doing good teaching, producing or training good students who are starting their own teams and doing their science. What I want to achieve is something that might not be seen as excellent science when you look from a world perspective. I just want to make the Czech Republic a place where we have some X. I don't know if we are going to get to [publish in] *Nature*. But if we establish a running X facility, if we will be able to train some students who will be able to do X, that would be a sign of excellence.

4.7 Epistemic responsibility in this account means not only meeting the highest external standards in a research field (publication in a renowned Western journal) but also a responsibility towards 'local' students and fellow enquirers to building independent facilities and researchers.

4.8 This vignette suggests that an individual's narrative of community encompasses a range of meanings, practices and experiences that are not exhausted by any single analytical frame. J's story of becoming a member of the X community through participating in a range of local communities can be usefully described

in the frame of community of practice. What leads me to argue that the X community is also an epistemic community (rather than merely a stable epistemic culture) is the sense in which J's mobility is in Markus's (1998) terms a 'recalibrating practice' that brings to the fore different configurations and textures of the X community in different places and times. At the same time there is a strong sense in the narrative of J's identification with a larger but distinct community of practitioners who are not co-located and whose members do not necessarily know each other personally but nonetheless are present in everyday practice through mailing lists, databases and other technologies. While this community is not, as Knorr-Cetina (1981) would perhaps have pointed out, a unit of knowledge making, it is nevertheless a site where knowledge standards and practices are being negotiated, and a sense of belonging and researcher identity is being defined. Significantly, building the X community 'at home' becomes a distinct life project and responsibility for J by which the X community is not merely extended but also transformed. While J's journeys at this point seem to add up into a conventionally masculine linear upward career path, she also stresses the importance of caring for and cooperation with others, practices that culturally are associated with femininity (Townley 2006). Needless to say, the stories that could be told about the X community cannot be exhausted by a single narrative of one of its drivers. Further insights particularly into potentially limiting or exclusionary practices are likely to be gained by following the stories of those, in the Czech study often women, who have moved out of and sometimes into other kinds of epistemic communities.

Is the physical science laboratory an epistemic community?

5.1 In contrast to the assumption that the research laboratory is an epistemologically adequate location to study epistemic cultures (Knorr-Cetina 1999) and communities of practice (Duguid 2005), the previous two vignettes have already implied that the laboratory is not a sufficient unit of analysis for studying epistemic communities. Here I want to consider this claim in more depth by drawing on part of the observational research I conducted in a physical science laboratory and offices and focus in an exemplary way on what became visible but also what remained invisible for me as an observer.

5.2 Spending time with junior and senior researchers turned my attention to different kinds of epistemic practices, their rhythms and the way they produced space. PhD students and post-doctoral researchers were located in two laboratories with office space and were mostly doing experimental work which included tuning the instrument, running reactions, saving and analysing data, and entering it in Excel sheets. Even though they were co-located with others, researchers usually did these things on their own, 'working together apart' (Kerr and Lorenz-Meyer 2009). Periods of experimentation were followed by writing up findings in the form of first drafts of journal articles. Observations in the lab spaces gave me a sense of 'laboratory life', the constant humming of the instruments, the chill produced by the air-conditioning, the tediousness but also complexity of 'routine' practices that came to the fore when researchers could not get the instrument to perform or could not make sense of their data, the ways work stalled when instruments broke down or collaborators abroad did not send their contributions in time. Senior scientists and the lab leader were mostly working in the office, and their principal activity was writing on the computer which included revising articles, filling out travel or order forms, writing grant applications and reviews, and last but not least engaging in ubiquitous email correspondence with collaborators, administrators, referees, journal editors and other colleagues. These observations produced a strong sense that senior scientists and the laboratory leader in particular were intensely networked in formal and informal ways: she was a key control or passage point not only in terms of warranting experimental designs and findings of the lab but also in mediating and managing connections and collaborations of the group, most apparently perhaps when the office remained empty as the group leader attended meetings, gave lectures, visited collaborators and so forth.

5.3 On occasion these two 'worlds' intermingled physically and intellectually when the lab leader visited the laboratory, or a junior researcher came to the office to consult his work. These occasions give a strong indication that working in the lab was also a means of introducing members to the particular ways of perceiving, speaking and acting of a community, and that the practices in the lab and office co-constituted community. An example: when a newcomer arrived the lab leader introduced her to the workings of the principal instrument. This was learning by doing: while the new researcher was sitting next to her the lab leader calibrated the machine and then ran a simple reaction that she used to demonstrate how the instrument was handled, to explain its principal configuration, the features of the operating system and how they could be manipulated. This also involved the articulation of experiential knowledge standards on what constituted sufficient signal intensity, what was a reliable interval for scanning data or what was likely to make the operating system crash. The researcher then tried out first steps on her own, after which the lab members went to discuss what she had done. That the researcher was able to do this with some degree of success indicates that while she was new to the particular technique she had been trained in the discipline and worked on similar instruments before. The explanations of the lab leader notably did not include an explication of what kind of science the instrument afforded – making an epistemic subject did not start in the laboratory. Neither of course did it end there, nor was it confined to crafts-based knowledge.

5.4 Another example: a postdoctoral researcher once came into the lab leader's office after a reviewer had rejected a co-authored article for the second time, this time on the grounds that empirical data was inaccurate. He brought with him a table which he had compiled over the previous two days. Using a major database in the field he had looked at published research with similar experimental set-up and documented the reported margins of error in experimental conditions similar to their own to show that their findings were within this margin. Like the lab leader, he was convinced that the alleged inaccuracy of data was not the 'real reason' for the rejection. But while he opted for submitting the paper to another journal to get it published fast, the lab leader wanted to submit the table as supporting evidence for contesting the review for a second time. From the references they were previously asked to include the researchers had deduced the probable identity of the reviewer. Upon rereading the work of this scientist the lab leader found that their findings contradicted a model previously proposed by the reviewer. She then detailed this in a letter to the co-authors as justification for writing to the editor-in-chief. Their study, she wrote, questioned 'established dogmas' in the field. Contestation over findings and models then is a situation where epistemic frames and standards of a community are made explicit in the lab as science studies scholars have long argued (Collins 1983). They also introduce junior researchers to the practices and rules of the (publishing) game where in the words of the lab leader 'you sometimes fight with your gloves off' – an idiom that brings to the fore also the extent to which doing science was strongly associated with combative masculinity in some situations.

5.5 The point I wish to make here is that by following these activities in laboratory and office spaces, I got a partial and emerging sense of *how* things came to be, how work was allocated, how instruments were acquired, how data was produced, written up and submitted for publication (including what had to be made explicit, and what could be omitted for specific audiences), how some collaborations were build and maintained, and also to some extent who and what was involved. About three quarters of the group's publications were co-authored with scientists from other research groups. But I did not get much of a sense of how the wider epistemic field was structured and whether and how the multiplicity of relations – materialised in the ubiquitous traffic of chemicals, students and co-authored papers – formed or sustained distinct epistemic communities. Precisely what a relevant epistemic community was appeared to change according to context: it sometimes was the distinct sub-specialisation, and in other cases senior scientists saw themselves participating in several different fairly distinct communities within this specialisation.

5.6 Hence I would answer the question whether the chemistry laboratory *is* an epistemic community in the negative, or at least qualify it: the laboratory/office is part of one or more epistemic communities, or more precisely it is a location where some of the practices that make these communities are enacted as I illustrated above. But this is not a nested hierarchy. One could also say that epistemic communities are part of the lab: epistemic standards are incorporated into (commercially available) instruments and important journals were shelved in the office. But the laboratory cannot be taken as a microcosm of an epistemic community: there are other places where epistemic communities are made such as the seminars, conferences, or meetings with funders. It is not possible to deduce from the stratifications of epistemic authority or the (ambiguous) genderings of epistemic practices in the lab the ways in which such authority or gendering may be distributed in larger collectivities, although such hierarchies and differences are likely to be at play. The life times of laboratories, or their experimental and publication cycles are not the life times of epistemic communities: in short, laboratories are only partial sites to trace the histories, dynamics, genderings and interrelations of epistemic communities with other knowledge projects.

Concluding remarks

6.1 In this paper I have sought to contribute to developing and researching the concept of epistemic community for the study of science, technology and society as part of a wider effort to specify and distinguish what Amin and Roberts (2008: 354) call 'different socialities of knowing in action'. I have argued that rather than regarding the evocation of community as hopelessly idealised, or limiting epistemic community to the currently most widely cited conception of a transnational community of policy experts bound together by shared values (Haas 1992a), it is productive to open up the diverse connotations of the concept in a range of different literatures. This brought to the fore overlaps with potentially competing analytical frames such as epistemic culture, technosocial network and community of practice, particularly in the insistence on the inseparability of the technical and the epistemic. But it also brought into relief some more distinctive features of epistemic community, namely the concept's heuristic focus on historical contingencies and more definable beginnings and endings of knowledge communities; a focus on the shifts between as well as simultaneities of co-located and distanciated relations of knowing in which belonging to a community is defined; the coherence of epistemic communities around particular epistemic projects and technologies that often work as boundary objects; a focus on interrelations with other knowledge projects and communities; and last but not least a focus on epistemic responsibilities.

6.2 With respect to the latter the work of feminist epistemologists begins to raise questions of epistemic

responsibility that may arise for those who identify as members of an epistemic community for particular problem definitions, epistemic standards and practices and 'the objects and the subjects that emerge in the process of cutting up, dissolving or otherwise manipulating the world so as to get to know it' (Mol in Bauchspiess and de la Bellacasa 2009: 341). Speaking from a privileged position of white Australians vis-à-vis indigenous Australians Gatens and Lloyd (1999) have argued that because identities are necessarily relational, constituted in particular configurations of sociality, members of their community are responsible for these formations and their constitutive imaginaries including the enactment of (racialised and gendered) boundaries and exclusions that are embedded in social institutions. In her work on 'geographies of responsibility' Massey (2004) has conceptualised responsibility in spatial terms, arguing that people living in and identifying as members of a 'global city' concur responsibility for the relations with other parts of the world through which this identity is formed and on which it depends. Importantly Massey acknowledges the unequal positioning of people within a particular location, arguing that public debate should address precisely 'how those small and highly differentiated bits of all of us which position us as "Londoners" give rise to responsibility towards the wider relations on which we depend' (Massey 2004: 17). If, as I have suggested, epistemic community approaches are concerned with the histories, antagonisms and futures of particular knowledge projects, and the ways in which they are differently configured and interrelated with other projects in different knowledge habitats, research on epistemic communities seems well suited to address questions of epistemic responsibility.

6.3 Methodologically I have suggested that beyond the analysis of existing documents and interview research an inquiry focused on epistemic communities goes well with modes of multi-sited ethnography that have been developed over the past 15 years (Markus 1998; Hine 2007). Contours, distributions and textures of an epistemic community cannot be studied at a single analytical site. To take an example, rather than studying the epistemic culture of high energy physics in a single laboratory, an inquiry of epistemic community would be interested in tracking and tracing where, when and how a synchrotron community evolves in particular places and times in conjunction with particular funding possibilities, epistemic imagination, possibilities for career development and expectations about benefits of a range of other communities – and when it ends, as was the case with the Czech synchrotron user community that dissolved when funding of the synchrotron was not endorsed by national policy makers. What appropriate research sites may be in such mobile and connective ethnographies the researcher cannot assume prior to the investigation (Hine 2007).

6.4 Based on my empirical research I have suggested that following the designers and spokespersons of particular epistemic technologies may be one avenue into researching the making of epistemic community; following community making events and the kinds of expectations and imaginings articulated as scientists lobby for investments into their epistemic projects is another. Biographical narratives of researchers who move into and out of particular locations and communities, often across national boundaries, and who combine co-located and distanciated forms of knowledge making can further contribute to teasing out changing configurations of community over time and the ways epistemic projects are bound up with researcher identity.

6.5 My research vignettes have also indicated that members of an epistemic community do ask questions of epistemic responsibility about the merits of particular knowledge projects, about masculine enactments of covert networking and about caring for students and junior collaborators although these were not publicly articulated. But epistemic responsibilities do not reside with epistemic communities alone that are themselves entangled with other kinds of communities and knowledge projects. Publics, funders, and other expert communities are also answerable as to what kinds of knowledge communities they imagine and support. By contributing to articulating tensions between different practices and imaginations of epistemic community so that they can be more widely reflected upon, researchers of epistemic communities also enact versions of community, for which they too are responsible.

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Notes

[1]Gieryn (2005: 551) foregrounds the elitism and stratifications within scientific communities, arguing that 'the careers and reputations of "star" scientists rest in part on the labors of many who may never be in a position to compete: skilled technicians, failing graduate students, permanent post-docs'. Kerr and Lorenz-Meyer (2009) have shown how these positions of facilitative work, often but not necessarily carried out by women, became feminised in terms of precariousness, lack of remuneration and career progression.

[2]The term enactment signals an approach to reality where 'things' (genders, protons, tables, disciplines etc) come into being with the practices in which they are manipulated: reality does not precede practices but is part of them. Hence the focus is on sociomaterial practices and practicalities by which they are enacted (see e.g. Mol 2002).

[3]'Communitarian' cultures such as high energy physics give rise to 'mono-gendered' performances where researchers display relatively uniform masculine comportment whereas 'dual gender' is enacted in more individualised cultures such as molecular biology that rely on embodied skills and reinforce a gendered division of labour where women often perform more technical and less valued work (Knorr-Cetina 1999: 232).

[4]The project 'Knowledge, Institutions and Gender: An East-West Comparative Study' (2006-2008) funded under the 6th Framework Program's Science and Society Program (SAS-CT-2005-017617). The project investigated contexts and cultures of knowledge production practices in the social and biosciences from a gender and geopolitical perspective. For more information see http://www.knowing.soc.cas.cz.

[5]The centrality of the size of the national synchrotron community was corroborated in a subsequent evaluation commissioned by the Ministry of Education in an effort to rank proposed Centres of Excellence. The report critically noted that the proposing team 'did not manage to demonstrate the existing potential in terms of users of the facility at the national level. In this respect, the proposal relies to a large extent on foreign users' (Ministry of Education, Youth and Sport 2008: 27).

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